

REMARKS

I. Introduction

For the reasons set forth below, Applicants respectfully submit that all pending claims are patentable over the cited prior art references.

II. The Rejection Of Claims 12, 13 And 15 Under 35 U.S.C. § 102

Claims 12, 13 and 15 were rejected under 35 U.S.C. § 102(e) as being anticipated by Derraa et al. (U.S. Pub. No. 2003/0075802). Applicants respectfully submit that Derraa fails to anticipate the pending claims for at least the following reasons.

With regard to the present invention, claim 12 recites a semiconductor device comprising a tungsten plug buried in a hole provided in an insulating film, a portion of the tungsten plug which is formed on a bottom surface of the hole having a columnar structure, an average value of a diameter of a bottom portion of the columnar structure being 30 nm or less.

The Examiner cites paragraphs [0003], [0004] and [0008] of Derraa as evidence that Derraa anticipates claim 12 of the present invention. Derraa states, in paragraph [0003], that “Typically, in forming a contact plug, a thin layer of titanium is deposited over the top of a silicon base layer, and tungsten or other electrically conductive plug material is then deposited...to fill the contact hold. However...tungsten does not provide an adequate fill for high aspect ratio features”. In paragraph [0004], Derraa continues, “*titanium nitride* films have attractive properties that may *overcome the limitations of tungsten plugs* as integrated circuit devices continue to *shrink below 0.15 micron* (150 nm) dimension.” Thus, as is evident from the above cited passages, Derraa teaches away from the use of a tungsten plug having dimensions of

less than 150 nm. Otherwise, with respect to the use of *tungsten* as a plug material, Derraa is silent with respect to the dimensions of the plug, and the structure of the plug.

Furthermore, the Examiner *alleges* that paragraph [0008] of Derraa teaches a portion of the tungsten plug having a columnar structure with an average value of a diameter of a bottom portion of the columnar structure being 30 nm or less. However, paragraph [0008] discloses a semiconductor device comprising a *titanium nitride film* whose thickness is about 200 angstroms or greater formed in a bottom portion of the opening. There is no mention in paragraph [0008] about the use of tungsten. Moreover, paragraph [0003] further states, and paragraph [0008] states that “the present TiCl_4 -based titanium nitride films are particularly useful as conductive contacts *to replace tungsten plugs in high aspect ratio features*”. Thus, Derraa, *teaches away* from the use of a tungsten plug of 30 nm or less, a columnar structure, or of the use of a tungsten plug at all. Accordingly, Derraa fails to anticipate claim 12 of the present invention.

As anticipation under 35 U.S.C. § 102 requires that each element of the claim in issue be found, either expressly described or under principles of inherency, in a single prior art reference, *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 218 USPQ 781 (Fed. Cir. 1983), and at a minimum, Derraa does not disclose an optical pickup comprising ... a tungsten plug which is formed on a bottom surface of the hole having a columnar structure, an average value of a diameter of a bottom portion of the columnar structure being 30 nm or less, it is clear that Derraa does not anticipate claim 12 or any claim dependent thereon.

III. All Dependent Claims Are Allowable Because The Independent Claim From Which They Depend Is Allowable

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claim 12 is patentable for the reasons set forth above, it is respectfully submitted that all pending dependent claims are also in condition for allowance.

IV. Conclusion

Having fully responded to all matters raised in the Office Action, Applicants submit that all claims are in condition for allowance, an indication of which is respectfully solicited.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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Date: August 4, 2006